

Wireless WAN technologies

There are two basic types of wireless service networks available in the wide area environment.

Voice service networks

Although these networks are used primarily for voice, data can be accommodated. These networks compute their charges based on "time in use."

Specialized mobile radio

Specialized mobile radio (SMR) is a two-way radio system operated by a commercial service, which owns and maintains the base station and holds the necessary radio licenses. You can easily subscribe to an SMR system.

In the past, SMR systems have focused on voice, but they are now introducing data services. This expansion will be made slowly, however.

Cellular (circuit switched)

Cellular telephone systems use radio signals to connect mobile users to the land-line telephone network. Cellular networks can be used for voice, data, and fax transmissions.

Subscribers to a cellular network are charged based on the amount of time that they are connected to the network. Therefore, cellular is well suited for large messages, such as faxes, rather than short ones.

Cellular is essentially a regional service because subscribers are clients of a local company. But many cellular systems are now installing "roaming" software, which allows subscribers to use their cellular devices in other service areas.

Personal communication services

Personal communication services (PCS) is a digital service that will enable users to make calls from lightweight, portable handsets or to send data by using small wireless computers. PCS may encompass a broad range of services, such as advanced paging and wireless e-mail, in addition to voice.

PCS services are expected to become widely available in three to five years.

Data service networks

These networks include traditional radio-paging networks and networks that use packet-radio technology.

Paging

Radio paging was originally established as non-speech, one-way, personal selective calling with alert, without message, or with defined messages. Current paging systems may include limited capabilities for two-way communication and delivery of short voice messages.

Packet radio

Packet-radio networks support two-way exchanges of short messages and are well suited for field-service solutions. Information is transmitted in groups of data called packets. Subscribers are charged based on the number of packets transmitted.

ARDIS

Advanced Radio Data Information Service (ARDIS) is a nationwide (U.S. and Canada) packet-radio network that provides two-way, interactive, real-time data communications. ARDIS also provides deep in-building coverage from coast to coast. In 1993, ARDIS announced support for automatic nationwide roaming, which supports wireless users when moving from one city to another, and ARDISmail, which supports wireless modems and provides gateways to other mail systems.

RAM Mobile Data

RAM Mobile Data is a national, two-way packet radio network using the Mobitex architecture, which is managed by the Mobitex Operators Association. RAM Mobile Data provides host connectivity, connectivity to third-party information services, and broad e-mail connectivity; registration is automatic and roaming is supported.

Cellular Digital Packet Data

Cellular Digital Packet Data (CDPD) is an overlay network providing packet data over an analog cellular voice infrastructure.

Newly announced CDPD products and services from the network providers will provide a more reliable, and potentially less expensive, solution than transmitting over a circuit cellular analog network. Furthermore, subscribers are expected to be charged for only the number of data packets transmitted. However, the rate structure for this service is not yet available and will vary by service provider.

Comparing wireless network services

Network	Type of service		Transmission speed (bps) (2)	Geographic coverage (3)	Basis of charges
	Voice	Data			
SMR (1)	Yes	Being introduced	4,800	Metropolitan areas	Varies
Cellular (circuit switched)	Yes	Accommodated	2,400	Widely available	Monthly charge plus rates/time
PCS	Yes	Potential	To be determined	To be determined	To be determined
ARDIS	No	Yes	4,800 19,200 (being introduced)	90% of U.S. business activity	Minimum charge (with packet allowance) and rates/packet volume
RAM Mobile Data	No	Yes	8,000	90% of U.S. urban population	Minimum charge and rates/packet volume
CDPD	No	Yes	19,200	Emerging	To be determined
Notes: (1) SMR is expanding from local message service providers into cellular-like phone services with nationwide network potential. (2) Data throughput may be 25% to 50% less than the transmission speed. (3) As of January 1994.					

Value added networks

A value added network (VAN) is a network provider of public data communications, such as Advantis. VANs provide you with a variety of wireless and mobile solutions, all from one place. They provide connectivity between the wireless WAN and your enterprise network.

After answering these questions, you should have a sense of direction and be prepared to start developing a technical strategy.

For example, if you need a wireless WAN so that your traveling employees can regularly communicate with the main office, then a cellular system might be appropriate.


But if you need a network that simply enables you to send and receive brief messages, then you might consider a packet radio or CDPD network.

Choosing a wireless WAN service

Wireless communications requires end-to-end network planning and preparation. Planning now can give you the potential for a competitive advantage in the future. If you think a wireless WAN service is right for your business, you need to consider the following factors:

- ☐ Who will use the service? When? Where? How?
- ☐ What type and size of the message or data will be transmitted?
- ☐ What kind of performance will you need?
- ☐ What will be the range or geographic coverage required?
- ☐ What kind of security and network management will you need?
- ☐ When do you plan to implement the wireless network?


The wireless revolution



Wireless communications represents personal communications of the '90s. Wireless solutions provide logical presence through physical mobility. You can stay in touch whenever you want, wherever you are.

You can view your e-mail, update your calendar, place an order, send a fax, call a customer, check your inventory—all from your virtual office.


You can avoid wiring expenses for temporary communications or for when wiring is impractical. When wire lines are down, wireless communications can be your backup network.



Now is the time for communicating through a wireless network to gain a competitive advantage, achieve cost savings, and improve customer conveniences. Many wireless technologies are available today. You can communicate with small, reliable, energy-efficient devices that are priced low enough for widespread use. And many public and private networks with wireless capability are emerging today.

You have already given the power of personal computers on LANs or even WANs to your employees. The next step is to give them the power of mobility via wireless data technology.

As you gain a general sense of direction in terms of wireless capabilities, you might want to engage a firm that offers assistance in planning and providing a solution. And if you need assistance in choosing the right mix of wireless products, for a complete wireless solution, IBM and its partners are prepared to help you.



The wireless revolution of the '90s is here. And "We're in this together!"

Glossary

access point. A network component that provides connectivity between a wireless LAN and a wired LAN. See also *base station*.

ad hoc network. A wireless LAN dynamically created for a specific, usually short-term, purpose, such as a class or a meeting. Ad hoc networks may or may not have access to wired LANs.

Advanced Mobile Phone System (AMPS). The standard for analog cellular telephone service in the U.S. AMPS systems are also used in a number of other countries worldwide. AMPS networks are circuit-oriented and support both voice and modem data traffic.

analog. The standard method of transmitting a radio telephone call. The call is converted into electrical impulses that travel in the form of radio waves, which are similar to the sound waves of the original voice.

ARDIS. Nationwide packet-radio network providing two-way data communications. It provides host connectivity, connectivity to third-party information services, and e-mail and messaging services.

base station. The controller for a wireless cell, often serving as an access point to a fixed (wired) network and relaying traffic among the members of the cell. Base stations are used in hub-oriented wireless LANs and in wireless WANs, such as cellular telephone networks and packet-radio networks.

carrier sense multiple access/collision avoidance (CSMA/CA). A scheme for multiple users to share a common channel. Nodes contend for access by listening before transmission (carrier sense). If collisions occur, further collisions are avoided through the use of random backoff times before retransmission.

cell. The geographic unit forming the basis of a cellular system. Cells vary greatly in size, from a few meters for some wireless LANs to hundreds of kilometers for some satellite systems. Use of smaller cells can increase system capacity roughly proportionately to the square of the cell radius. See *micro-cellular*.

Cellular Digital Packet Data (CDPD). An overlay network providing packet data transmission over an analog cellular (AMPS) infrastructure. Data is transmitted between conversations or through unused voice channels.

cellular system. A system that reuses scarce radio spectrum on a geographic basis to provide a radio communication service. An area (a region, a city, or a building) is divided into partially overlapping cells, each with a base station. The base stations are typically connected via a wired network. Connections can be handed off to adjacent cells to maintain connectivity as a user moves. The cellular telephone network is the best known cellular system.

channel. (1) An instance of medium use. For narrowband systems, a channel is a width of a spectrum band. For example, cellular telephone systems typically use 30 kilohertz channels. For spread spectrum systems, CDMA techniques can be used to create multiple channels that share the same spectrum band. (2) A duplex pair of frequencies.

circuit cellular. The use of cellular telephone connections for data communications. Contrast with *Cellular Digital Packet Data (CDPD)*.

code division multiple access (CDMA). An approach to sharing spectrum whereby individual transmissions are separated by encoding. The two most common means of encoding are frequency-hopping spread spectrum and direct-sequence spread spectrum. CDMA is one of the technologies used for the second-generation, digital cellular telephone systems in the U.S. See also *frequency division multiple access (FDMA)* and *time division multiple access (TDMA)*.

Cordless Telephone 1 (CT1). First generation cordless phone standard. CT1 uses analog, narrowband FM transmission. See also

Cordless Telephone 2 (CT2) and *Digital European Cordless Telecommunication (DECT)*.

Cordless Telephone 2 (CT2). Second generation cordless telephone standard using digital transmission. CT2 is used for telepoint services. See also *Cordless Telephone 1 (CT1)*, *Digital European Cordless Telecommunication (DECT)*, and *personal communications network (PCN)*.

digital. The transmission method for sending voice or information using computer binary code. This is accomplished by transmitting on/off electrical pulses.

Digital European Cordless Telecommunication (DECT). European standard for providing local-area wireless voice and data services. DECT is often associated with cordless telephones, but it is also a system for providing wireless LAN services. See also *personal communications network (PCN)*.

direct-sequence spread spectrum (DSSS). A technique for signaling involving the mixing of an information-bearing signal with a coded pseudo-random digital signal generated at a much higher rate. This spreads the information signal over a much broader bandwidth. The bits of the higher rate signal are called chips, and the ratio of the higher rate signal to the information data stream is called the spread ratio.

frequency. The number of cycles per second of an electromagnetic wave. The unit for measuring frequency is hertz (Hz).

frequency division multiple access (FDMA). A technique for sharing finite spectrum among a large number of users whereby the available spectrum is divided into a number of individual radio channels (often pairs of send and receive channels). See also *code division multiple access (CDMA)* and *time division multiple access (TDMA)*.

frequency-hopping spread spectrum. A technique for signaling whereby the available spectrum is divided into a large number of bands, and users, or groups of users, "hop" from band to band in rapid sequence. This synchronized hopping creates logical communications channels. Interference between groups is minimized through the use of orthogonal codes, which are hopping patterns that minimize the number of times two groups will be in the same band at the same time.

frequency reuse. The ability to reuse radio frequencies within a cellular system, thereby increasing the capacity of the system, given the constraint of limited radio spectrum. The AMPS cellular telephone system achieves this by assigning a subset of the available frequencies to a cell and reassigning these same frequencies to non-adjacent cells.

Global System for Mobile Communication (GSM). The pan-European standard for digital cellular telephone systems that provides for roaming throughout Europe. GSM uses a TDMA structure with eight slots per carrier, with the carriers spaced 200 KHz apart. There is also broad interest in GSM outside of Europe. Originally called *Groupe Speciale Mobile*.

hertz. One cycle per second; a unit for measuring frequency. In radio communications, it is often used with a prefix. Common forms are: kilohertz (KHz, thousand cycles per second), megahertz (MHz, million cycles per second), and gigahertz (GHz, billion cycles per second).

industrial, scientific, and medical (ISM) bands. Three radio bands (902-928 MHz, 2.4-2.4835 GHz, and 5.725-5.875 GHz) in the U.S. that can be used for wireless LANs and a variety of other uses such as microwave ovens and anti-theft systems. Frequency-hopping and direct-sequence spread spectrum wireless LANs can use these bands without the need for a license from the Federal Communications Commission (FCC), provided that they operate at power levels of under one watt and meet the other requirements of the FCC Part 15.247 regulations. Part of the 2400 MHz band is now available worldwide.

infrared (IR). Thermal radiation with wavelengths longer than that of visible light. Like visible light, infrared is blocked by walls. It can be modulated to transmit data. It is used as either a point-to-point (line-of-sight) beam or as a diffused beam. The diffused beam spreads out and can be reflected off ceilings and walls. Diffused IR has less range and speed and is more sensitive to interference from ambient light, but it does not have to be carefully aimed.

micro-cellular. Cellular services using small cells. Smaller cells allow for greater frequency reuse (and therefore greater total system capacity) and for lower power transmission (allowing longer battery life and lighter batteries). However, smaller cells require more access points, and micro-cellular systems have to handle more frequent handoffs.

multiple access. Techniques that allow for the sharing of a single communications channel among a community of distributed users. Two levels of multiple access need to be distinguished for wireless communications: 1) Creating a common subchannel that can be used by a pair or more of users. This is done with pure FDMA or combinations of FDMA with TDMA or CDMA. 2) Managing shared access to this subchannel. This is accomplished with contention-based techniques such as CSMA/CA or by controlled-access techniques such as reservation (demand-adaptive) TDMA schemes.

narrowband. (1) A characteristic of technologies using FDMA. (2) In cellular radio, the methodology of gaining more channels by splitting channels into multiple, narrower channels. See also *narrowband PCS*.

narrowband PCS. The frequency allocation in which, in 1993, the Federal Communications Commission (FCC) allocated 3 MHz in the 900 MHz band for emerging services such as advanced paging and other data services. Networks using frequencies in this band are known as narrowband PCS systems.

packet radio. The application of packet technology to radio links. This allows sharing channels between multiple users, which is more cost effective for many data applications. Packet-radio networks can also be more reliable than sending data over networks designed for voice traffic. Contrast with *circuit cellular*.

personal communications network (PCN). Micro-cellular service, supporting users with handheld telephones moving at pedestrian speeds in urban areas. Initially, it will support lower telephone function than cellular, but with lower cost. Services may range from one-way (telepoint) to two-way advanced cordless telephones. CT2 and DECT are standards commonly associated with PCN. See also *Cordless Telephone 2 (CT2)*, *Digital European Cordless Telecommunication (DECT)*, and *personal communications services (PCS)*.

personal communications services (PCS). An evolving term with numerous meanings. Often, PCS refers to micro-cellular wireless services providing voice and data communications to stationary or slowly moving users; cell-to-cell handoffs at vehicular speeds are not expected to be supported. PCS is also used to refer to "one-number" services that associate a number with an individual, not a device, telepoint phone service, wireless PBXs and wireless LANs, two-way paging, and other emerging voice and data services. The micro-cellular design is expected to allow for lower power operation--allowing smaller, lighter telephones with longer time between battery recharges. See also *narrowband PCS*, *personal communications network (PCN)*, and *unlicensed PCS band*.

Personal Computer Memory Card International Association (PCMCIA). An industry group that defines standards for PC cards that conform to the standard are about the size of credit cards. There are three types with varying thickness: 3.3 mm, 5 mm, and 10.5 mm.

private mobile radio (PMR). Private networks providing wireless voice and data communication to organizations such as state and local police. Some networks are provided by consortia and serve multiple sponsoring organizations. PMR networks typically address industry-vertical, dedicated applications.

RAM Mobile Data. National two-way packet radio network using the Mobitex architecture. RAM Mobile Data provides host connectivity, connectivity to third-party information services, and broad e-mail connectivity.

roaming. In LAN terms, refers to a user moving between cells. For cellular phone subscribers, it refers to the use of a phone outside the usual service area.

specialized mobile radio (SMR). A two-way commercial radio service operating in the 800-900 MHz frequency bands. SMR services may support voice or data or both. SMR carriers have historically been local service providers. Some SMR carriers such as Nextel are now expanding their coverage areas and upgrading their infrastructure to provide cellular-telephone-like service, further blurring the lines between SMR, cellular telephone, and PCS.

spectrum. The range of wavelengths or frequencies of electromagnetic radiation, including radio waves and light.

spread spectrum. A system in which a logical channel with a relatively narrow bandwidth is carried on a physical channel with a much wider bandwidth. See also *direct-sequence spread spectrum (DSSS)* and *frequency-hopping spread spectrum*.

telepoint phone service. A micro-cellular telephone service that allows handsets to make calls but not to receive them. Telepoint services do not support cell-to-cell handoffs.

time division multiple access (TDMA). An access architecture in which a channel is subdivided into multiple time slots. Pure TDMA systems create multiple logical channels by assigning the logical channels to regularly occurring time slots. GSM carries eight telephone calls on a single radio channel. TDMA is one of the technologies being used by second-generation, digital cellular telephone services in the U.S. See also *code division multiple access (CDMA)* and *frequency division multiple access (FDMA)*.

unlicensed PCS band. A 40 MHz band (1890-1930 MHz) recently allocated by the Federal Communications Commission (FCC) for unlicensed use. This band is divided into two 20 MHz blocks: one for voice-like (isochronous) services and one for data-like (asynchronous) services. New rules for unlicensed PCS address band-clearing of the incumbent microwave operations and establish a spectrum etiquette. Also called user-PCS.

value added network (VAN). Public data communications network that offers a variety of wireless and mobile solutions from one source.

Additional terms

Notes



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